LOCKOUT / TAGOUT PROCEDURE
FOR
SILICON PURGE AIR SYSTEM
INGERSOLL-RAND AIR COMPRESSORS

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Reviewed & Approved: R. RUCINSKI 7/1/04

1.0 EQUIPMENT LOCATION: D-Zero Assembly Building, Room 604

2.0 EQUIPMENT IDENTIFICATION / DESCRIPTION:

Two Ingersoll-Rand 25 hp air compressors used for the Silicon Detector Purge Air System. Units are designated as East & West, East being closest to the room entrance. Service disconnects are located on an overhead power raceway.

3.0 SCOPE OF WORK:

3.1 This procedure applies to all work performed on either compressor package, which involves: Removal of safety guards; disassembly of pressure components (a.k.a. "wetted parts") in the process stream or lubrication stream; or work on high voltage components.

3.2 All work on compressor skid components described in 3.1 involving removal of safety guards or disassembly of pressure components shall require both ELECTRICAL and MECHANICAL lockout sections of this procedure.

3.3 Where work to be performed is exclusively electrical, and does not involve removal of machine guards or disassembly of pressure components, the ELECTRICAL lockout section of this procedure may be used without the MECHANICAL lockout section. (Note that the noise enclosure side panels are not considered machine guards for the purposes of this section.)

3.4 Excluded from this requirement is work on components designed with provision for isolation and venting for routine maintenance (e.g. valved filter housings); small sensor lines & gauges which can be valved off from process, and minor adjustments to operating control components which do not require opening pressure boundaries (e.g. modulating regulator).

3.5 Work involving disassembly of wetted parts on the glycol side of the oil coolers must **also** address LOTO requirements for the glycol cooling system pump skids, as well as environmental precautions.

4.0 AUTHORIZED PERSONS:

All D-Zero Cryogenic Operating Crew and supervisors, with LOTO Level II and current Specific LOTO Procedures training, are authorized to perform this procedure.

5.0 NOTIFICATIONS:

In addition to affected personnel, the following persons shall also be notified **prior** to initiating this procedure, depending on the conditions as noted below to trigger notification:

A) PROJECT ENGINEER (R. Rucinski X2888 pgr.: 630-218-3927, cell ph. 630-846-2527) Whenever work on an offline compressor will make the offline unit unavailable for more than one shift; or whenever **both** compressors may be offline for more than the normal switchover time of 2-5 minutes).

B) SHIFT CAPTAIN, D-ZERO CONTROL ROOM: (x8800) Whenever a switch of online compressors is required; or whenever **both** compressors may be offline for more than the normal switchover time of 2-5 minutes).

C) SILICON DETECTOR EXPERT: (W. Cooper X4093, pgr: 630-722-0538, hm. ph.: 630-879-8547) Whenever **both** compressors may be offline for more than the normal switchover time of 2-5 minutes).

6.0 SOURCES OF HAZARDOUS ENERGY:

6.1 High voltage electrical power may be present; including 480 VAC 3ph 60Hz and 115 VAC 1ph 60Hz control power. Both are controlled at the service disconnect for each compressor located on the overhead power raceway, and labeled as east & west air compressors.

6.2 Compressed air may be present at pressures up to 125 psig. Source from other compressor online. After isolation, stored energy from internal pressure is still present until vented.

6.3 Pressurized heated oil may be present at pressures up to 125 psig and temperatures up to 250 degrees F.

6.4 Hot exposed surfaces at temperatures up to 250 degrees F may be present during operation and immediately after shutdown of equipment.

6.5 Unguarded rotating parts even during un-powered hand rotation can have enough inertia, due to mass of parts, to produce injury. (e.g. belt / sheave pinching, fan blades, etc.)

6.6 MSDS for SSR Ultra Coolant makes fairly benign claims regarding toxicity and even skin and eye irritation, but require safety glasses with side shields and, if in contact with eyes to irrigate with water for 5 minutes.

7.0 LOCKOUT / TAGOUT CONTINUITY

7.1 Continuity of Lockout shall be provided as follows:

7.1.1 After the electrical disconnect and the corresponding compressor discharge isolation valve for the compressor to be maintained are placed in the lockout position, a lockout device shall be placed on the valve handle and secured with a lock. The key to this lock shall be captured on the ring portion of the group lockout device placed on the compressor electrical disconnect.

7.1.2 If only Electrical Work is to be performed, as described in paragraph 3.3, then the compressor discharge isolation valve lockout device & lock may be omitted. The electrical disconnect for compressor power must be in the de-energized position and have a group lockout device securing it.

7.1.3 Each authorized employee who will work on the job shall place his/her lock & tag on the group lock device on the electrical disconnect.

7.1.4 When the job extends past the end of shift and is passed on to the next crew, **the relieving shift must place its locks & tags on the group lockout device before the relieved shift is permitted to remove their locks,** such that at no time is the group lockout without any locks.

7.1.5 When the job extends past the end of shift, but is not passed on to the relieving crew, the relieved shift shall leave their locks on until the job is finished.

7.1.6 Prior to removing their locks & tags, the crew, which finishes the job, shall inspect the equipment and the work done on it to verify that the equipment has been returned to safe operating condition. This inspection shall also include checks that:

- All tools, materials and debris have been removed;
- All machine guards and power enclosures have been reinstalled;
- All drains and vents are closed; fill caps on and tightened properly;
- Fluid levels are correct;
- Individuals on the notification list above, and other affected workers have been notified of intent to return the equipment to operational status.

8.0 PREREQUISITE ACTIONS:

8.1 Planning and Coordination

8.1.1 Meet with system users to schedule equipment shutdown to minimize interference with operations.

8.1.2 Meet with authorized persons who will be performing the work to review this procedure and plan the job tasks. This would include a Job Hazard Analysis covering hazards beyond the scope of this LOTO procedure.

8.2 Performance Documents:

- Lockout Procedure (this document)
- MSDS for SSR Ultra Coolant
- Ingersoll-Rand Operators / Instruction Manual: APDD 298B-90

8.3 Prepare Tools, Supplies& Equipment:

- PPE (consult MSDS) (Personnel verifying electrical voltages must not wear clothing made from synthetic fibers.)
- Parts, fluids, seals, filters, etc.
- Waste containers, spill control materials, wipers.
- Tools , Voltmeter & special fittings, hoses, etc.

8.4 Disable Alarms related to Silicon Air Compressors (Autodialer & computer)

8.5 Shut Down Equipment

8.5.1 Switch over to Backup Compressor

8.5.1.1 Verify cooling water flow isolation valve to Backup Compressor is open: (East: MV 6170-GL or West: MV 6180-GL depending on which is serving as backup.)

8.5.1.2 Press UNLOADED STOP button on the online compressor

8.5.1.3 Switch Compressor Control Selector to its opposite position.

8.5.1.4 On the Backup Compressor, press START, wait 15 seconds, then press LOAD, then press LOAD again. (This puts it in Moduating mode)

8.5.1.5 On the compressor just shut down, close the cooling water isolation valve: (East: MV 6170-GL or West: MV 6180-GL depending on which is offline.)

WARNING:
FAILURE TO COMPLY WITH THE FOLOWING STEPS COULD RESULT IN DEATH OR SERIOUS INJURY!

9.0 LOCKOUT CHECKLIST:

9.1 SHUT OFF Power Disconnect for compressor to be worked on (Disconnects are located on the overhead power raceway.) **Required for both Electrical and Mechanical Lockout.**

9.2 CLOSE Discharge Isolation valve for the compressor to be worked on. (East: MV 6011-I or West: MV 6031-I) **Required for Mechanical Lockout.**

9.3 VENT compressor internal pressure by removing dust plug, and carefully **easing open** vent valve for the compressor to be worked on. (East: MV 6008-I or West: MV 6028-I) Leave vent open during maintenance. **Required for Mechanical Lockout.**

9.4 INSTALL lockout devices per 7.1.1 (**Mechanical Lockout)** or 7.1.2 **(Electrical Lockout only)** as required by scope of work.

9.5 EACH AUTHORIZED EMPLOYEE, who will be performing the work, **places** their lock and tag on the group lockout device on the Power Disconnect.

10.0 VERIFICATION OF LOCKOUT

10.1 VERIFY all personnel are clear of compressors & motors.

10.2 CHECK that control panel has no lights or lit display: There should be none.

10.3 CHECK that red "Crash" button is not depressed.

10.4 PRESS local compressor Start Button: Motor should not start.

10.5 VERIFY venting from **9.3** by checking gauges for the compressor to be worked on.(East: PI-6010-I or West: PI-6030-I).

CAUTION

In the event that display panel shows lights or readout, or compressor starts: IMMEDIATELY Press the red CRASH button to stop the unit; then call the Electrician to investigate. Do not proceed with work until the problem is corrected, and Verification of Lockout steps are repeated successfully.

10.6 ELECTRICAL WORK on exposed conductors requires that the following electrical verification **MUST ALSO BE PERFORMED** by personnel wearing non-synthethic garments and safety glasses with side shields:

10.6.1 TEST a voltmeter of appropriate range (0-600 VAC min.) on a known voltage source(e.g.: a working 110 VAC outlet).

10.6.2 REMOVE access panel to compressor skid control box, and, **without touching any exposed wiring,** locate the large motor contactor(M-1).

10.6.3 MEASURE the voltages between the frame ground and each input leg terminal on the contactor (L-1, L-2, L-3), and between the leg terminals. There should be no voltage present.

10.6.4 VERIFY that the voltmeter has not failed during the measurement, by re-testing on the same known source used in 10.6.1 .

CAUTION

If any of the terminals show voltage present, STOP. Call a qualified electrician to investigate. Do not proceed with work until the problem has been corrected, and Verification of Lockout steps have been repeated successfully.

11.0 PERFORM MAINTENANCE PROCEDURES per APDD 298B-90

12.0 RETURN TO SERVICE

12.1 VERIFY that all machine guards, electrical enclosures, and access doors are installed and secured.

12.2 VERIFY that all tools, excess parts & materials, and debris have been removed from the unit.

12.3 VERIFY that all vents, drains have been closed, and filters and fill caps are tightened correctly.

12.4 VERIFY that fluid levels are correct.

12.5 NOTIFY all affected personnel and individuals who were contacted under Section 5.0 of the intent to return the unit to operational status.

12.6 PLACE local controls in the OFF configuration.

12.7 REMOVE Locks and Tags, then return the electrical disconnect to the ON position.

12.8 EASE OPEN the Discharge Isolation valve slowly to equalize without causing a pressure drop in the header.

12.9 If putting online immediately, follow steps in section 8.5.1.

13.0 POST PERFORMANCE ACTIVITY

13.1 Return lockout locks to the LOTO station and close out the entry in the LOTO log.

13.2 Re-enable any alarms which were disabled.

13.3 Return to service status entry made in Operations Log.

13.4 Itemized details of work performed, parts replaced and hourmeter reading entered in appropriate section of Utility Log.

13.5 Dispose of waste fluids and materials in accordance with applicable rules.